Please add new claims 47-48 to read as follows:

Sub C1 47. (New) The heat exchanger of claim 10 wherein the inner array is spaced apart from the outer array, having an annular space therebetween.

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48. (New) The heat exchanger of claim 1 wherein the circular chamber comprises an overhead wall, and each of the plurality of heat conducting fins extends from the second surface of the heat conducting plate to the overhead wall.

REMARKS

Claims 1-4, 6-22, 29-31 and 35-48 will be pending upon entry of the present amendment. Claims 1 and 29 are amended and claims 47-48 are newly added

Applicant thanks the Examiner for indicating the allowability of claims 43-46, and the allowable subject matter of claims 9, 12-14, 16, 29-31 and 35-42. Applicant also thanks the Examiner for taking time for a phone conference with applicant's representatives after final. The conference was very helpful in clarifying the Examiner's position with respect to the rejection of the claims over the cited art.

Applicant has discovered various typographical errors in the specification. Accordingly, the specification is amended as indicated herein. No new matter has been added with these amendments.

A request for drawings change is included with the present amendment, in which Figure 2A is amended to correct errors in lead lines and reference numerals.

The Examiner has rejected claims 29-31 and 35-42 under 35 U.S.C. § 112, second paragraph, as being indefinite. Accordingly, claim 29 has been amended substantially as suggested by the Examiner, and is now in condition for allowance, together with its dependent claims.

The Examiner has rejected claims 1-4, 6-8 and 15 under 35 U.S.C. § 102(b) as being anticipated by Opitz et al. The Examiner argues that "a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations," and continues, saying that, "(i)n this instance, the functional recitations of an inlet and outlet are not structural limitations associated with the 'aperture'." Accordingly, claim 1 has been amended to

recite, in part, "a fluid aperture positioned at a central portion of the circular chamber, *configured to direct fluid entering the chamber to impinge against the second surface of the plate*." Support for this amendment may be found on page 3 of the specification, in the paragraph beginning at line 8, which reads, in part, "the structure allows for impacting the fluid on a central portion of a plate within a circular chamber to create turbulence in the fluid which results in an improved heat transfer coefficient." In contrast, Opitz teaches a device in which a flow distributor 2 introduces coolant into the flow chamber tangentially to the direction of flow in the chamber (col. 3, ll. 14-17). Thus, Opitz teaches away from the introduction of fluid in the center of the device, teaching, rather, the introduction of the coolant through distributors at one or more points along the periphery of the device, configured to introduce the fluid tangentially to the flow of coolant. Claim 1 is now clearly in condition for allowance. Dependent claims 2-4 and 6-17 are also now in condition for allowance.

With respect to the rejection of claims 2-4 and 6-8 over Opitz, Applicant feels that these claims are allowable on their own merits, apart from their dependence from an allowable claim. The Examiner has argued that Opitz anticipates the heat conducting fins recited in claim 1, citing column 3, lines 8-9 of Opitz, which read "swirl attachments such as pins, baffles, tripping wires or ribs for increasing the turbulence." While it may be argued that this line suggests fins, Applicant fails to find any reference in Opitz specifically disclosing fins positioned in a generally radial direction extending from a central region of the circular chamber toward a peripheral region, as claimed in claim 2, nor does Opitz teach fins arranged in a spiral pattern each fin extending from a central area of the chamber out toward a peripheral portion of the chamber, as claimed in claim 3. Opitz makes no teaching, beyond a mere hint, regarding the use of fins in the chamber, and certainly fails to disclose any structure, or configuration for the fins. An individual having ordinary skill in the art might imagine any number of rib or baffle configurations that will result in "increasing the turbulance" in the flow chamber, but Opitz has made no suggestion as to why one configuration may be more effective or useful than another. The Applicant, on the other hand, has disclosed specific reasons, beyond merely creating turbulence, for the claimed configurations (see, for example, paragraphs beginning on page 9, line 23 and page 10, line 9 of the specification). Accordingly, Applicant feels that claims 2 and 3 are allowable on their own merits. By the same token, claims 6-9, as dependent from claim 3, are also allowable together with claim 3.

The Examiner has rejected claims 10, 11, 18, 20 and 21 under 35 U.S.C. § 103(a) as being unpatentable over Opitz et al. in view of Kodama et al.

With respect to the rejection of claim 10, the Examiner has argued that the radiation fins F1-F60 are analogous to the inner and outer arrays of fins, as recited in claim 10. The Examiner argues that the stepped arrangement of the fins, as illustrated in Figure 7, which illustrates fin F31 and its constituent parts F31a and F31b, is analogous to the two concentric circular arrays recited in claim 10. While the Applicant continues to traverse this particular argument, Applicant points out that the stepped arrangement of the fins F1-F60 is made explicitly for the purpose of accommodating Kodama's impeller. Support for this is found in Kodama at column 8, lines 52-59, which reads, in part, "arrangement of the first and second sections at each of the radiation fins F1-F60 results in a stepped recess . . ., in which a part of the impeller is received. In the illustrated embodiment, a lower section of the impeller is received in the stepped recess." Additionally, Figure 7 makes clear the relationship between the blades 105 of the impeller 104, and the stepped region of the radiation fin F31a and F31b. There is no teaching or suggestion in Kodama that indicates that such a stepped configuration would be useful in any application, apart from the benefits derived by the combination of the stepped fins and the impeller. Thus, there is no teaching to combine fins of such a configuration with a device that does not employ an impeller or other moving parts.

The Examiner has argued that it would have been obvious at the time the invention was made to a person having ordinary skill in the art to employ in Opitz et al. a plurality of radial fin arrays arranged in a spiral pattern for the purpose of improving heat exchange efficiency as recognized by Kodama et al. However, inasmuch as: Kodama is the only piece of art cited by the Examiner which may be argued to include concentric arrays; Kodama's stepped fin configuration is made to accommodate the moving blades of an impeller; Kodama makes no claim that such a stepped arrangement is beneficial for improving heat efficiency, *per se*; and no other piece of art cited by the Examiner includes propellers, impellers, or any other moving blades; there is no teaching or suggestion to combine the stepped fins of Kodama with Opitz or any other of the cited art. For at least the above reason, Applicant feels that claims 10-14 are allowable over a combination of Opitz and Kodama.

While the scope of claim 18 differs from that of claim 10, Applicant feels that the arguments made in favor of claim 10 over Opitz in view of Kodama may also be applied in

support of the allowability of claim 18, namely, that there is no objective teaching or suggestion to combine Kodama with Opitz. Claims 18-22 are clearly allowable.

The Examiner has rejected claims 1-4, 7-8, 10-11, 17-18 and 20-22 under 35 U.S.C. § 103(a) as being unpatentable over Little in view of Kodama et al. With regard to the rejection of claim 1, the Examiner has argued that Little discloses all the claimed limitations except radial fins. Claim 1 recites, in part, "a heat conducting plate having a first surface positioned adjacent said semiconductor chip." In contrast, Little teaches the use of "circular plates 20, 22 and 24 of glass or similar materials of low thermal conductivity." Thus, Little fails to teach a heat conducting plate, or at the very least, makes clear that efficiency of heat conduction is not a central aim with respect to the materials used therein. The Examiner has argued "it would have been obvious at the time the invention was made to a person having ordinary skill in the art to employ in Little radial fin arrays arranged in a spiral pattern for the purpose of improving heat exchange efficiency as recognized by Kodama et al." However, as previously indicated, heat exchange efficiency is not a priority with Little, nor is an even distribution of cooling effects a priority, or even desirable, as might be expected to occur with the incorporation of the radiation fins of Kodama into the device of Little.

It may be instructive to examine the parameters and objectives of Little's device in comparison with those of Kodama's device. Little's device measures approximately .7 inches in diameter and .04 inches in thickness (col. 2, ll. 40-41), while the device taught by Kodama measures approximately 1.8 inches by 1.8 inches, with a thickness of approximately .26 inches, thus, Kodama's device is more than twice as wide and more than six times a thick as Little's device. As to their objectives, Little teaches a device which is intended to achieve extremely low temperature at a small localized area of the refrigerator for chips or superconductor devices of small dimensions, and for a relatively short duration (col. 1, ll. 22-37 and 48-49), while Kodama teaches a devices designed to operate quietly while reducing power consumption and improving durability of the cooling motor (col. 9, ll. 49-61), which suggests that this device is intended to operate continuously over a long period of time. Little, in turn, cares little about power economy, noise, or long or continuous operation, citing, as an application, the use of its device in "cooling infra red detectors in tactical missiles and precision guided munitions (col. 1, ll. 32-34)." Little teaches, as a primary and overriding objective, "to provide improved microminiature refrigerators . . .(that achieve the stated objectives) by providing extremely rapid cool down (col. 1, ll. 38-41)."

Little continues, "it has been discovered that the limiting factor in rapid cool down applications is the amount of heat which must be extracted from the material being cooled *including the material in the refrigerator itself*." Thus, Little uses materials having low thermal conductivity in order to limit the area of cooling to the smallest size possible. Little's device is effective to produce a temperature of 90°K in a few seconds after startup (col. 3, ll. 7-8), which is equivalent to -183°C. Kodama's device is effective in producing a temperature of 42°C (col. 9, ll. 43-44). In view of these comparisons, it is clear that there is no teaching or suggestion to combine Little and Kodama. In fact, the technologies of these two references are radically different and completely incompatible. Little teaches away from highly conductive materials such as radiation fins, and further indicates the limiting factor introduced by the material of the refrigeration device itself. The inclusion of radiation fins would be detrimental to this goal. Additionally, Little strives to cool a very small localized area of the device, while Kodama seeks to cool a much larger area over a very long period of time. Further, it is not reasonable to argue that features from a device that achieves a cooled temperature of 42°C may "improve heat exchange efficiency" in a device which achieves a temperature of more than 200°C cooler, without the use of those features. For at least the reasons cited above, Applicant feels that claim 1 is allowable over a combination of Little in view of Kodama.

With respect to the rejection of claim 18 over Little in view of Kodama, Applicant feels that the arguments already put forth in support of claim 1 may also be applied in support of claim 18, namely, Little and Kodama are vastly different in operation, and employ technologies and objectives that are so far apart as to make any combination unreasonable. Additionally, as previously argued, inasmuch as Little does not employ moving parts such as fans or impellers, there is no motivation to combine the stepped fin arrangement of Kodama with Little, as would be required in order to anticipate or suggest the limitations of claim 18. Therefore, claim 18 is allowable over the cited prior art.

The Examiner has rejected claims 1-4, 6-8 and 17 under 35 U.S.C. § 103(a) as being unpatentable over Little in view of Turner. With respect to the rejection of claim 1, a comparison of Little and Turner reveals similar incompatibilities to those encountered in the comparison between Little and Kodama. An examination of Turner reveals the following parameters and objectives: a diameter of 1.25 inches (col. 2, l. 27); a thickness of the cooling chamber alone of .625 inches (col. 3, l. 5); minimum temperature achieved is 0°F, or approximately -18°C (col. 3, l. 55); primary objectives of efficient operation over long periods of

time (col. 1, ll. 24-29), accurate regulation of rate of temperature change (col. 1, ll. 42-43), a uniform temperature over the entire tabletop surface without any localized cold spots (col. 4, ll. 16-17). Clearly, the features as well as the objectives of the devices of Little and Turner are not compatible, and therefore not combinable.

For example, Turner employs radial fins 22-27, to affect uniform distribution of the coolant (col. 3, ll. 74-75). A primary objective of Turner is to maintain a uniform temperature over the entire tabletop surface without localized cold spots. This is achieved by adding mass to a deflector cone to prevent overcooling of the center of the table (col. 4, ll. 11-17) and, as previously indicated, through the use of the radial fins to distribute the coolant. In contrast, Little strives for "maximum cooling being affected in the region of the port 34 and the recess 36 which is located immediately beneath the device 54 to be cooled which is mounted centrally on the upper surface of the plate 24" (col. 2, ll. 65-68). Little also recites provision for "maximum cooling at a small localized area of the refrigerator" (col. 1, ll. 48-49), in direct conflict with Turner's stated aim of eliminating "localized cold spots." There is no suggestion in Little or Turner to combine these technologies, inasmuch as they have radically different aims and different technologies. Little achieves a far higher degree of cooling, while Turner strives for economy and consistency, and arrives at a temperature that is approximately 165°C warmer than that achieved by Little. Again, there is no suggestion to add the fins of Turner to Little's device, inasmuch as they would actually reduce the effectiveness of Little's device. For at least these reasons, Applicant feels that claim 1 is allowable over a combination of Little and Turner, together with dependent claims 2-4, 6-8 and 17.

The Examiner has rejected claims 6, 19 and 22 under 35 U.S.C. § 103(a) as being unpatentable over Little in view of Kodama et al. and further in view of Turner. While these claims are dependent claims, and are thus allowable as depending from allowable independent claims, Applicant points out that, as previously indicated, Little is incompatible with the technologies taught by Kodama and Turner, and thus, there is no reasonable suggestion or teaching of a combination.

Claims 47 and 48 are submitted to protect additional features of the invention. Support for claim 47 may be found in the specification, beginning on page 6, line 27. Support for claim 48 may be found in the specification, beginning on page 7, line 9.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned "**Version With Markings to Show Changes Made**."

All of the claims remaining in the application are now clearly allowable. Favorable consideration and a Notice of Allowance are earnestly solicited.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Specification:

Paragraph beginning at page 5, line 4 has been amended as follows:

As best seen in Figures 1 and 2A, the heat exchanger assembly 10 is typically mounted atop a semiconductor package 12. The semiconductor package typically comprises a semiconductor chip ~~11~~17, socket 14, and a substrate 16 within which the semiconductor chip is disposed, and a lid or heat spreader 18.

Paragraph beginning at page 8, line 19 has been amended as follows:

As indicated previously, the heat exchanger 24, which includes the cylindrical turret head 20 and the fin plate 22, can be rotated within the heat exchanger assembly 10. This allows a user to selectively position the turret head 20 within the system board 11, so as to run tubing from the hose barbs. ~~a~~An arrow 27 on top of the turret head 20 provides a direction arrow of the fluid flow. Having the arrow 27 on the package itself makes it easy for an installer to see the direction of fluid flow within the computer as installed. Within the tight confines where a system board is disposed, the rotatable exchanger provides for easy access of the tubing to the heat exchanger from any user-selected direction.

Paragraph beginning at page 8, line 28 has been amended as follows:

Cooling fluid is introduced into the inlet conduit 76 of the exchanger 24 through the tubing and hose barbs, see Figure 5. The fluid travels laterally through the inlet conduit to the center portion of the cylindrical turret head 20 then turns at a right angle and travels downward through a vertical portion of the inlet conduit. The fluid exits the inlet conduit through the inlet aperture 72, centered over the center of the fin plate 22 as shown in Figure 6, and impinges on a central region 65 of the fin plate. Once the fluid impinges or impacts on the fluid plate, it makes a sharp bend, 90°, and spreads outward, in a generally radial direction, from the central region 65 toward the annular wall 32 of the fin plate, with substantially even distribution, through the flow channels defined by the fins 52, 54. The fluid direction thus changes dramatically from an

average downward velocity after exiting the inlet aperture, to an average lateral velocity transverse to the downward velocity. This sudden change in direction generates highly turbulent flow. The turbulence generated has the advantage of increasing convection as well as lowering the boundary layer thickness of the fluid on the fins 52,54, as well as other walls within the heat exchanger that are in communication with the fluid. These effects all contribute to a higher overall heat transfer coefficient for the heat exchanger 24.

In the Claims:

Claims 1 and 29 have been amended as follows:

1. (Twice ~~A~~amended) A heat exchanger, assembly comprising:

a semiconductor chip;

a heat conducting plate having a first surface positioned adjacent said semiconductor chip;

a circular chamber positioned above a second surface of the heat conducting ~~surface~~plate;

a plurality of heat conducting fins disposed within the circular chamber;

a fluid ~~inlet~~ aperture positioned at a central portion of the of the circular chamber, configured to direct fluid entering the chamber to impinge against the second surface of the plate; and

a fluid ~~outlet~~ aperture positioned at a peripheral region of the circular chamber.

2. The heat exchanger of claim 1 wherein the plurality of fins are positioned in a generally radial direction extending from a central region of the circular chamber towards a peripheral region;

3. The heat exchanger of claim 1 wherein the fins are arranged in a spiral pattern, each fin extending from a central area of the chamber out toward a peripheral portion of the chamber.

4. The heat exchanger assembly of claim 1 wherein the circular chamber comprises an overhead wall and there is at least one annular channel recessed upwardly into the overhead wall.

6. The heat exchanger of claim 3 wherein each fin extends laterally from a leading edge to a trailing edge with the trailing edge being closer to the peripheral portion of the circular chamber, and the fin being laterally curved in the direction of the spiral pattern

7. The heat exchanger of claim 3 wherein an outer perimeter of the circular chamber is defined by the inside surface of an annular wall, and there is at least one annular space in the chamber proximate the annular wall, between a trailing edge of the fins and the annular wall.

8. The heat exchanger of claim 7 wherein an overhead wall of the circular chamber has at least one annular fluid channel recessed upwardly into the wall.

9 The heat exchanger of claim 8 wherein the annular channel of the overhead wall has a varying cross sectional area with the area being greatest at a distance furthest from the fluid outlet aperture and the area being at a minimum adjacent the fluid outlet aperture.

10. The heat exchanger of claim 1 wherein the fins are arranged in at least two concentric circular arrays, comprising at least an inner array and at least an outer array, each circular array comprising a plurality of fins arranged in a generally radial pattern with each fin extending from a leading edge of the fin to a trailing edge of the fin, the trailing edge being positioned radially outward of the leading edge closer to a peripheral region of the circular chamber.

11. The heat exchanger of claim 10 wherein the fins of each circular array are arranged in a spiral pattern, each fin have a leading edge and a trailing edge, with the trailing edges of the fins being positioned closer to a peripheral region of the circular chamber than leading edges.

12. The heat exchanger of claim 10 wherein the circular chamber has at least two annular space regions, with at least a first annular space being between the inner array and outer array of fins, and at least a second annular space being between the outer array of fins and an inside surface of an annular wall of the chamber.

13. The heat exchanger according to claim 12 wherein an overhead wall of the circular chamber has at least one annular fluid channel recessed upwardly into the wall, the annular fluid channel being disposed over at least one of the annular space regions in the circular chamber.

14. The heat exchanger of claim 13 wherein the annular fluid channel has a varying cross sectional area, the cross sectional area being greatest at a distance along the channel furthest from the fluid outlet aperture and at a minimum adjacent the fluid outlet aperture.

15. The heat exchanger of claim 2 wherein an outer portion of the circular chamber, has a varying cross sectional area.

16. The heat exchanger of claim 15 wherein the cross section area of the outer portion of the chamber is greatest at a position diametrically opposed to the position of the fluid outlet aperture.

17. The heat exchanger of claim 2 wherein the fluid inlet aperture is positioned in overhead wall of the circular chamber at the center of the wall and the fluid outlet aperture is positioned in the overhead wall at the periphery of the wall.

18. A heat exchanger for cooling a device, comprising:

a heat conducting surface;

a fin plate in contact with the heat conducting surface, and having two concentric circular arrays of fins, comprising an inner array and an outer array, each circular array comprising a plurality of fins arranged in a generally radial pattern, extending outward from an inner region of the respective array toward an outer region thereof;

an annular wall extending upwardly from the fin plate;

an overhead wall with a recessed annular channel, the overhead wall, the fin plate and the annular wall defining a fluid chamber of the heat exchanger;

a fluid inlet aperture disposed at the center of the overhead wall; and

a fluid outlet aperture disposed at the periphery of the overhead wall.

19. The heat exchanger of claim 18 wherein the fins are curved in a radial pattern into a spiral shape.

20. The heat exchanger of claim 18 further comprising a conduit chamber disposed above the overhead wall of the fluid chamber, the conduit chamber housing a outlet conduit connecting the fluid outlet aperture to an opening on the outside wall of the chamber, and further housing an inlet conduit connecting the fluid inlet aperture to an opening on the outside wall of the conduit chamber.

21. The heat exchanger of claim 20 wherein the conduit chamber is a cylinder.

22. The heat exchanger of claim 21 wherein an external fitting is threadedly engaged to the outlet conduit through the corresponding opening on the outside wall of the cylinder and an external fitting is threadedly engaged to the inlet conduit through the corresponding opening on the outside wall of the cylinder, the fittings being configured to mate with external conduits for transferring fluid to and from the heat exchanger.

29. (Twice Amended) A method for cooling a semiconductor chip, comprising:

impacting a cooling fluid against the central region of a plate within a circular chamber;

distributing the fluid through the chamber;

withdrawing heat from the semiconductor through the plate and into the fluid; ~~and~~

discharging the fluid through an outlet aperture located at a peripheral portion of the circular chamber; and

attaining even distribution of the fluid throughout the circular chamber as it flows towards the periphery of the chamber by equalizing pressure drop for substantially equal flows rates, from the center of the plate, in any radial direction, to the fluid outlet aperture of the chamber, by varying the fluid velocity of the fluid about the periphery of the circular chamber, and by ~~comprises~~ increasing the fluid velocity as it approaches the fluid outlet aperture.

30. The method according to claim 29 wherein distribution of the fluid through the chamber comprises directing the fluid in a generally radial direction to the periphery of the circular chamber.

31. The method according to claim 29 wherein distribution of the fluid through the chamber comprises directing the fluid in a spiraling direction from the center of the plate towards the periphery of the circular chamber.

35. The method according to claim 31 wherein equalizing the pressure drop comprises varying the cross sectional area of an outer portion of the circular chamber.

36. The method of claim 29 further comprising increasing an individual heat transfer coefficient of the fluid by increasing turbulence and reducing boundary layer thickness of the fluid on a wall within the circular chamber by changing momentum of the fluid.

37. The method of claim 36 wherein changing the momentum of the fluid comprises directing the fluid in a curved spiral flow pattern.

38. The method of claim 29 further comprising attaining uniform distribution of the fluid through the chamber by spreading the fluid in a generally radial direction and reducing back pressure against the radial flow.

39. The method of claim 38 wherein reducing the back pressure against the radial flow comprises imparting rotational velocity to the fluid on the outer perimeter of the chamber.

40. The method of claim 29 further comprising attaining uniform distribution of the fluid through the chamber by spreading the fluid in a generally radial direction and creating a low pressure zone about the periphery of the chamber.

41. The method of claim 29 further comprising reducing boundary layer thickness on a heat transfer surface by introducing a space between two heat transfer walls

wherein fluid communication with the walls is momentarily broken while the fluid travels between the walls.

42. The method of claim 29 further comprising increasing the overall heat transfer area by providing a curved heat transfer surface.

43. A heat exchanger for a semiconductor chip comprising:

a heat conducting surface;

a circular chamber positioned above the heat conducting surface;

a fluid inlet aperture in the circular chamber;

a fluid outlet aperture in the circular chamber.

a plurality of heat conducting fins disposed within the circular chamber and arranged in at least two concentric circular arrays, comprising at least an inner array and at least an outer array, each circular array comprising a plurality of fins arranged in a generally radial pattern with each fin extending from a leading edge of the fin to a trailing edge of the fin, the trailing edge being positioned radially outward of the leading edge closer to a peripheral region of the circular chamber; and

wherein the circular chamber has two annular space regions, with a first annular space being between the inner array and outer array of fins, and a second annular space being between the outer array of fins and an inside surface of an annular wall of the chamber.

44. The heat exchanger according to claim 43 wherein an overhead wall of the circular chamber has at least one annular fluid channel recessed upwardly into the wall, the annular fluid channel being disposed over at least one of the annular space regions in the circular chamber.

45. The heat exchanger according to claim 43 wherein an overhead wall of the circular chamber has an annular fluid channel recessed upwardly into the wall and having a varying cross sectional area, the cross sectional area being greatest at a distance along the channel furthest from the fluid outlet aperture and at a minimum adjacent the fluid outlet aperture, the annular fluid channel being disposed over at least one of the annular space regions in the circular chamber.

46. A heat exchanger for a semiconductor chip comprising:

a heat conducting surface;

a circular chamber positioned above the heat conducting surface;

a fluid inlet aperture positioned at a central portion of the of the circular chamber; and

a fluid outlet aperture positioned at a peripheral region of the circular chamber; and

an outer portion of the circular chamber having a varying cross sectional area, wherein the cross section area of the outer portion of the chamber is greatest at a position diametrically opposed to the position of the fluid outlet aperture.

Claims 47-48 have been amended as follows:

47. The heat exchanger of claim 10 wherein the inner array is spaced apart from the outer array, having an annular space therebetween.

48. The heat exchanger of claim 1 wherein the circular chamber comprises an overhead wall, and each of the plurality of heat conducting fins extends from the second surface of the heat conducting plate to the overhead wall.

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